



NASA SBIR 2005 Phase I Solicitation

X12.04 Advanced Environment Monitoring and Control

Lead Center: JPL

Participating Center(s): GRC, JSC

This subtopic addresses monitoring and control technologies, which support the operation of an Advanced Life Support (ALS) system for future long duration space missions. There are two application areas: Acoustics Monitoring and Environmental Controls.

Acoustics Monitoring Section

The objective is a proof-of-concept acoustic sensor system consisting of fixed and crew-worn transducers. At least ten fixed transducers shall be distributed in a habitable volume of at least 2x2x6m. The goal for the fixed microphones is to provide sound pressure level measurements with Type I measurement accuracy over the Octave Band frequency range from 63 Hz through 20 kHz. The system shall be capable of measuring 1/3 Octave Band, Octave Band, and Narrow Band sound pressure levels averaged over a specified interval with user defined data acquisition parameters. The fixed microphones shall also operate as an acoustic dosimeter with Type III accuracy and shall measure and log the maximum, A-weighted, Overall Sound Pressure Level every 30 seconds for at least 24 hours. The system shall also detect Hazard Levels of 85+ dBA and generate an alarm. The crew-worn transducer, clipped to a shirt collar, shall operate as a Type III acoustic dosimeter and shall measure and log the maximum, A-weighted, Overall Sound Pressure Level every 30 seconds for at least 24 hours. The size and mass of the device shall be comparable to COTS dosimeters. All system measurements shall be carried out remotely and the data managed by software. The system shall be demonstrated in a mock-up, and calibrations and comparisons made with appropriate instruments and methods.

Environmental Controls

Advanced Environmental Controls - the development of advanced control system technologies is necessary for the integrated operation of environmental systems for future long-duration human space missions. The interdependence of advanced environmental processing systems requires a non-avionics requirements process that allows design for controllability. This year particular emphasis is placed on the following:

- Control strategies for closed-loop systems - closed loop and biological systems have different constraints and control paradigms than conventional processes. There is a need for new control algorithms, analyses, design methodologies, strategies, and techniques to provide this capability;
- Ontologies for integrated operations - human exploration missions involve hundreds of systems developed by dozens of organizations. To develop software that can integrate across these systems and integrate with operations requires the use of common terminology across multiple disciplines. A common ontology must be developed to enable the integration of control of advanced life support systems; and
- Development and integration of autonomous system and inter-system control with crew and ground

operations - there is a need for tools, architectures, and technologies that can support the integration of operations between crew, ground operators, ground applications, and on-board applications.